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Karsten

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(54) **MULTI-POSITION PAINT ROLLER**

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Related U.S. Application Data

(63) Continuation-in-part of application No. 09/490,417, filed on Jan. 24, 2000, now abandoned, which is a continuation-in-part of application No. 09/041,507, filed on Mar. 12, 1998, now abandoned.

(51) **Int. Cl.**[7] **B05C 1/08**

(52) **U.S. Cl.** **492/19**; 492/16; 492/13; 15/230.11

(58) **Field of Search** 15/230.11, 144.2, 15/144.1; 403/84, 142, 83, 87, 93, 86, 91, 92; 492/13, 16, 19; 29/895.2, 428, 525.01; 81/177.8, 177.9, 489

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(57) **ABSTRACT**

A paint roller apparatus for use with a tubular paint applicator including a shaft, a tube-receiving frame, a handle, and a connector. The shaft defines a first end and a second end. The tube-receiving frame is rotatably attached to the second end of the shaft. The handle includes a leading section that defines a plurality of shaft-receiving passages and a bore. The passages are sized to slidably receive the first end of the shaft. The bore extends in a generally perpendicular fashion relative to an axis of each of the passages, intersecting each of the passages. The connector includes a shank sized for placement within the bore. Upon insertion of the first end of the shaft into one of the passages, the shaft is selectively locked relative to the handle via advancement of the shank within the bore.

20 Claims, 6 Drawing Sheets

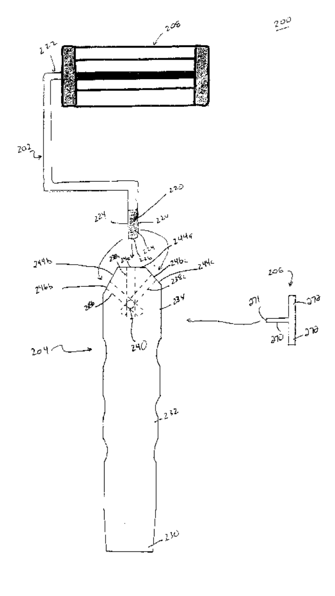

Fig. 1

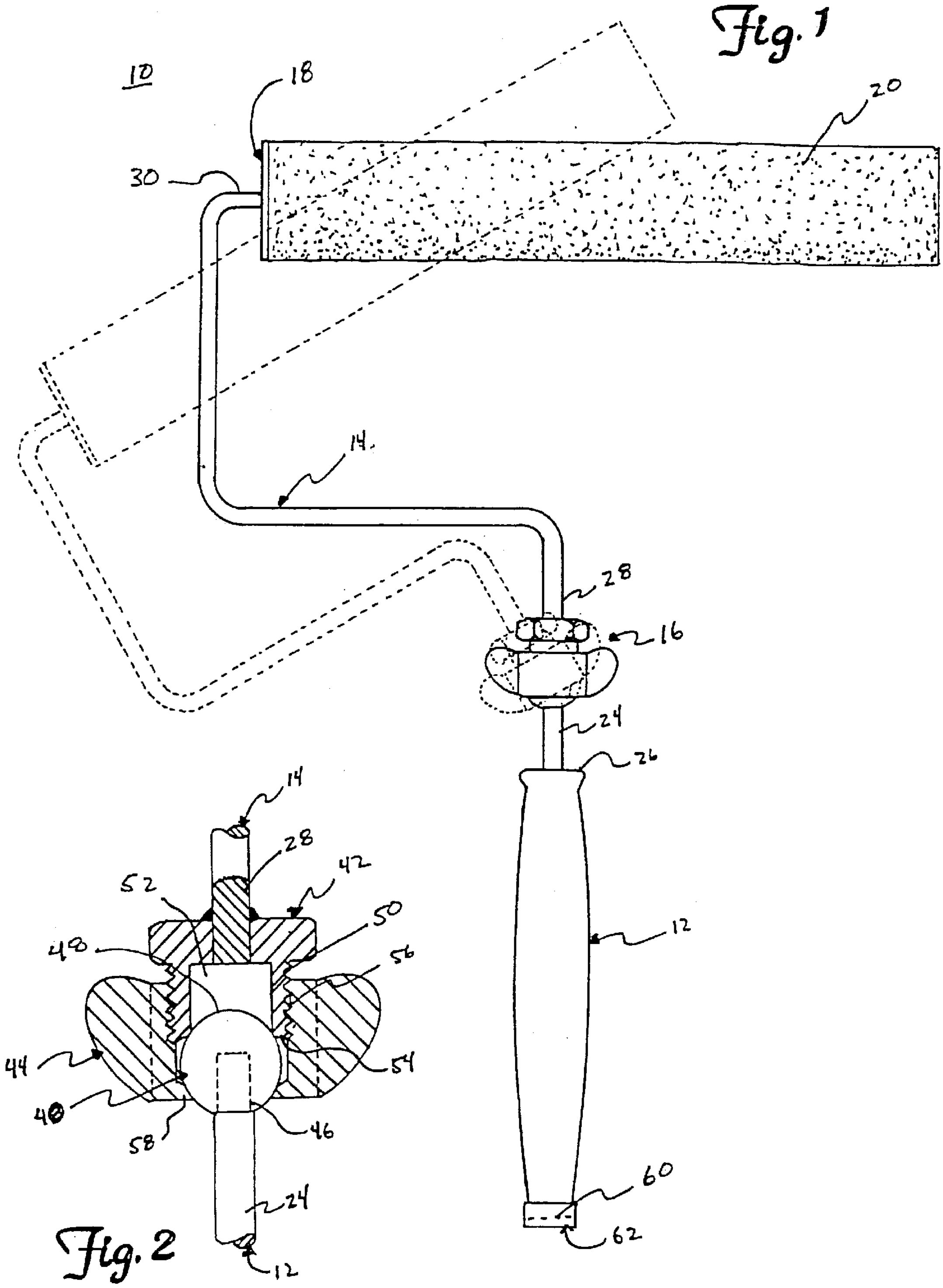
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Fig. 2

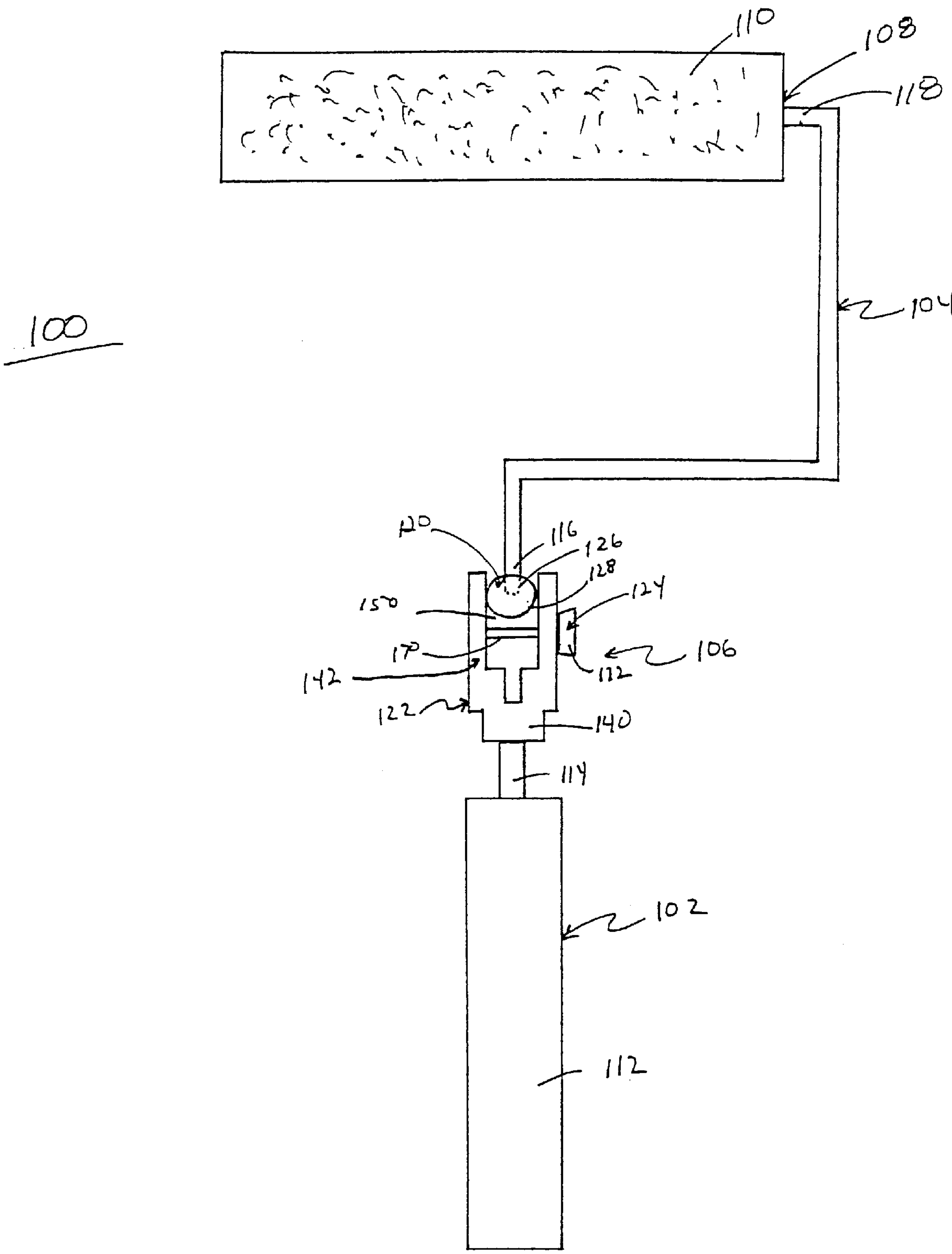

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FIG. 3

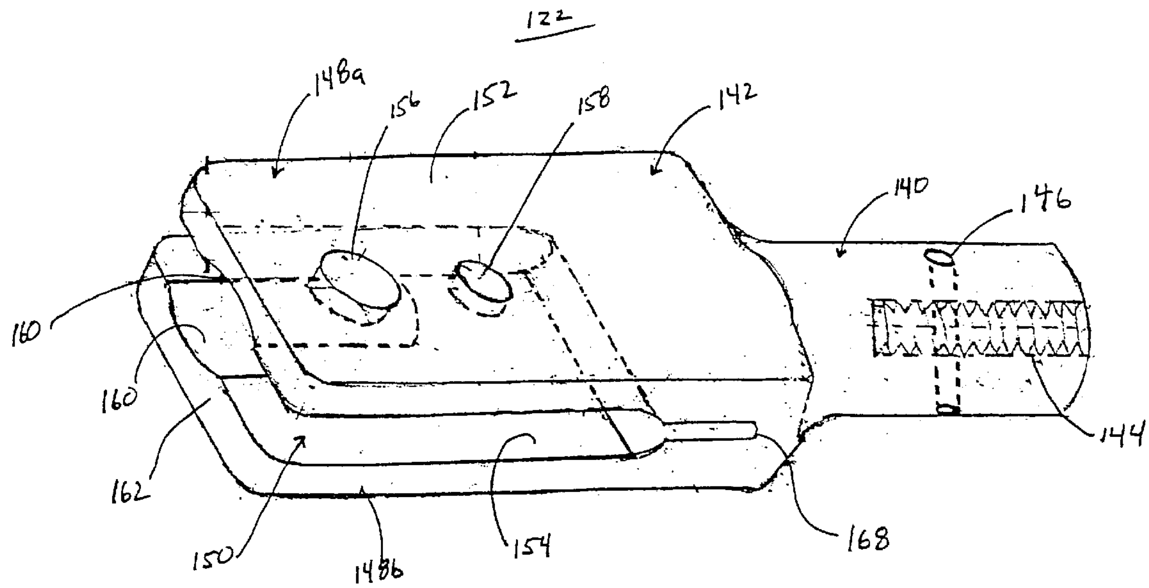
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FIG. 4A

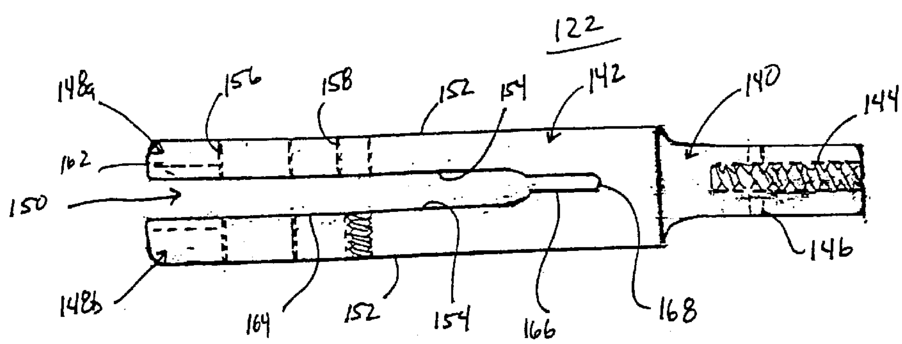
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FIG. 4B

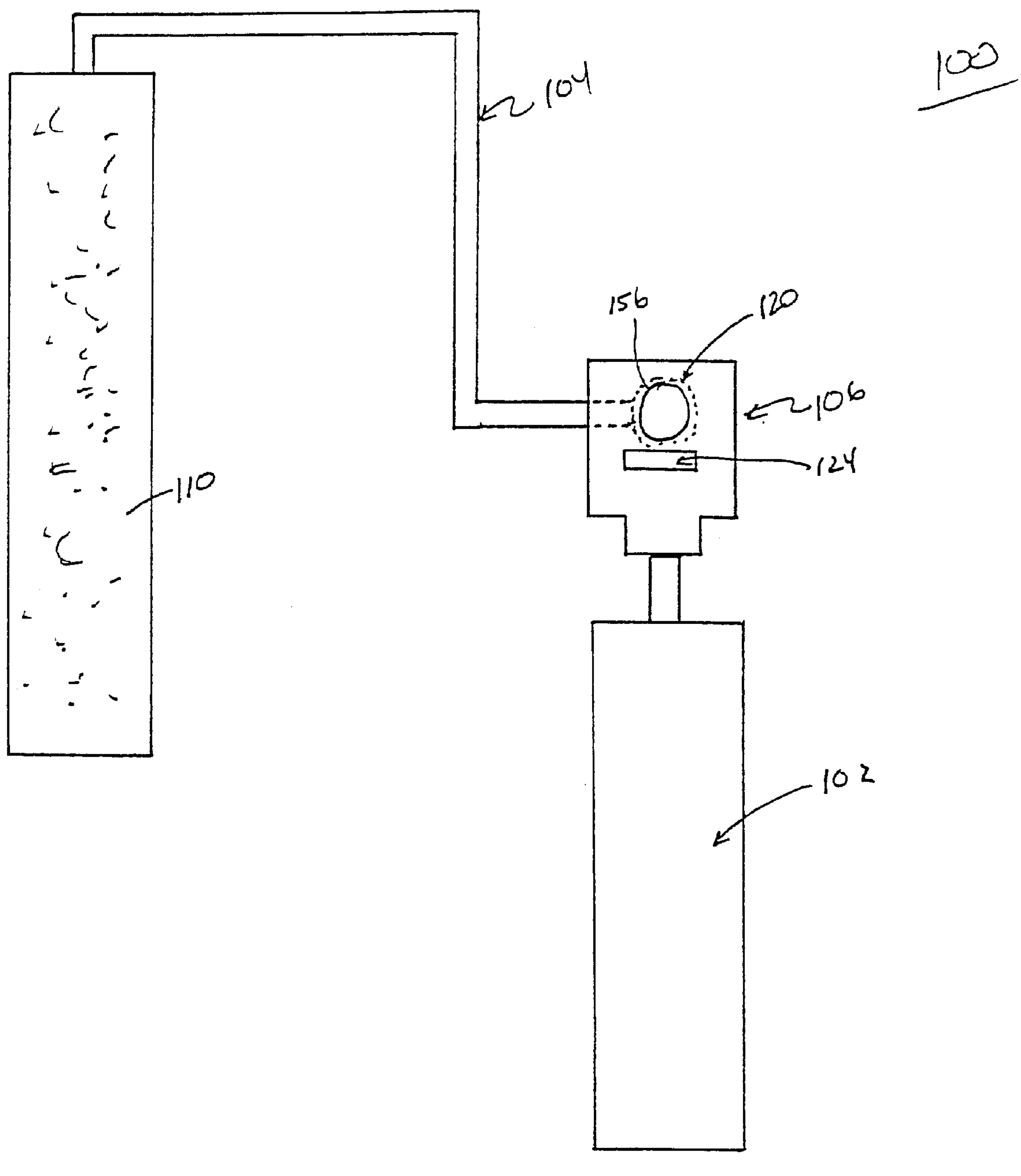

FIG. 5

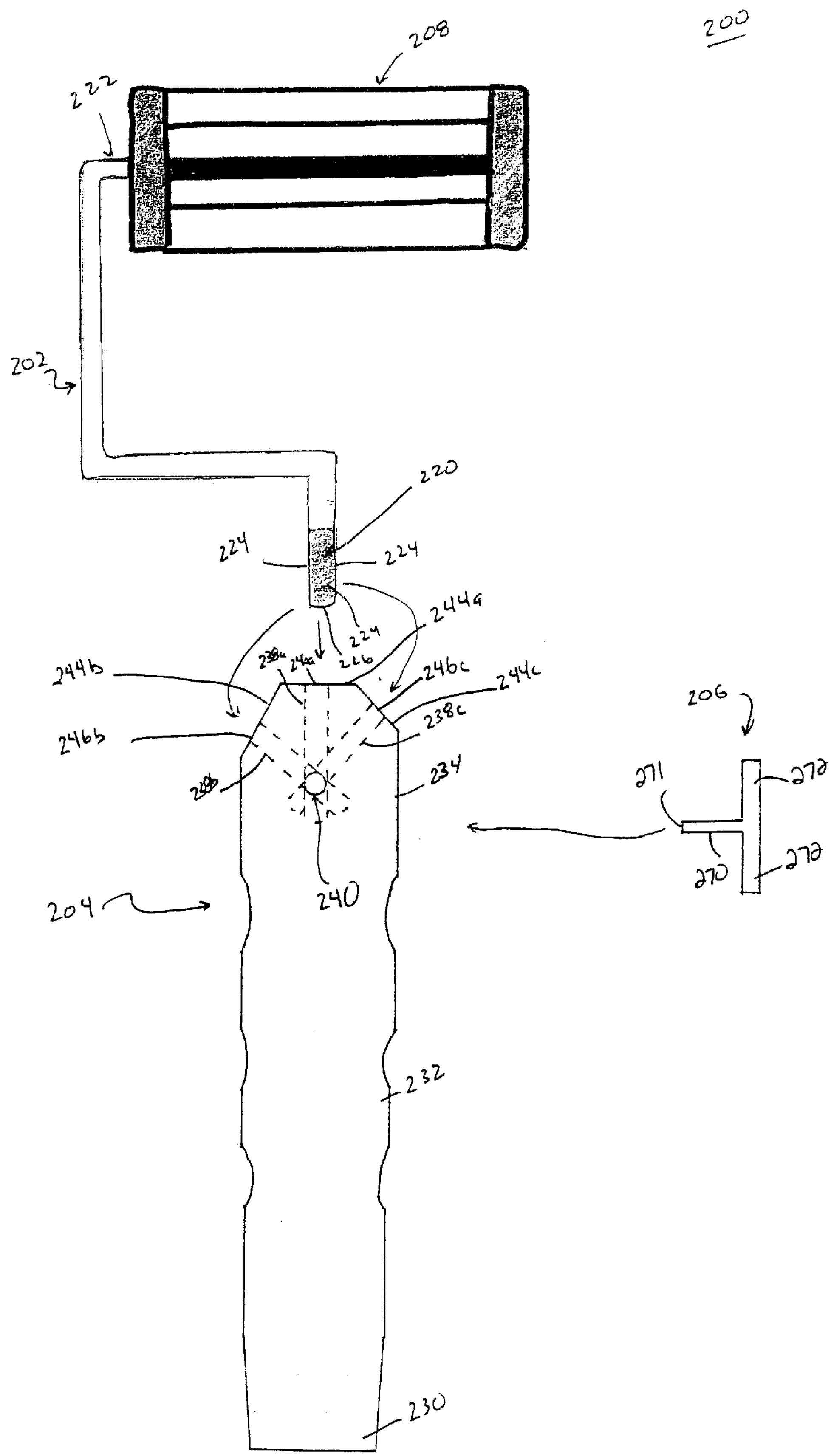
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FIG. 6

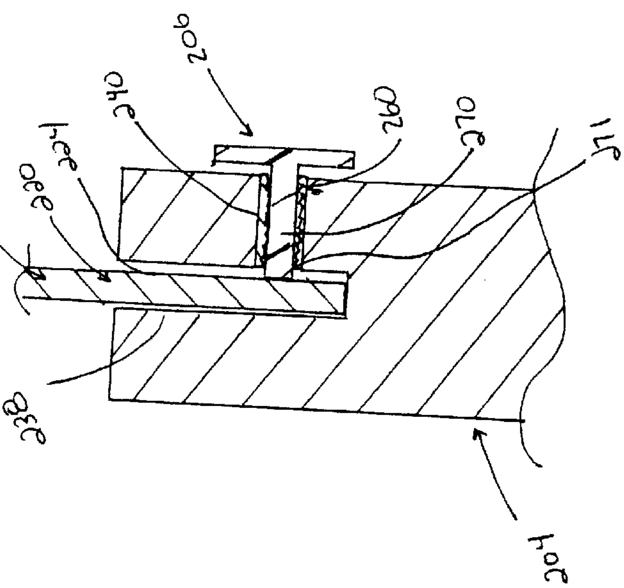
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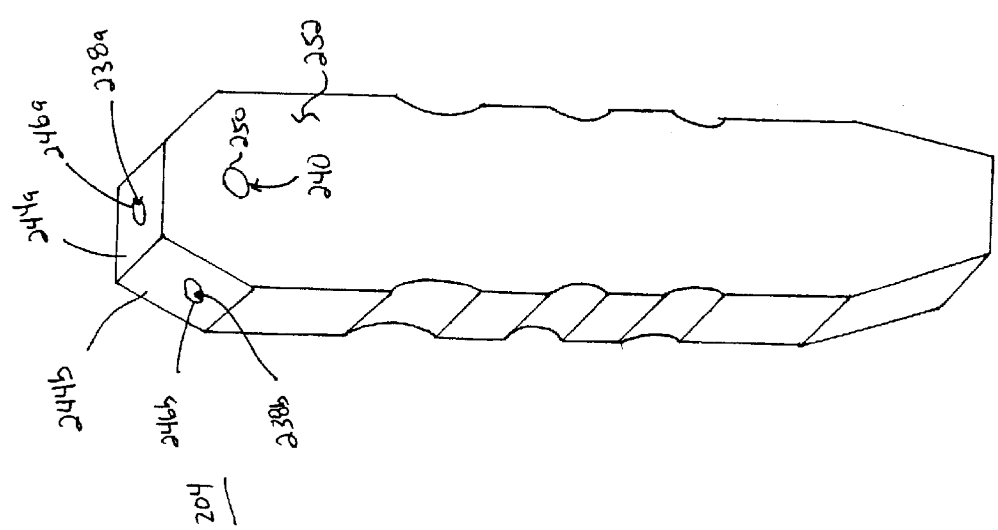
FIG. 8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240
252
244b
246b
238b
204

FIG. 7

MULTI-POSITION PAINT ROLLER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. patent application Ser. No. 09/490,417 now abandoned, entitled "Paint Roller with Flexure Joint" and filed Jan. 24, 2000, which is a continuation-in-part of U.S. patent application Ser. No. 09/041,507 now abandoned, entitled "Paint Roller With Flexure Joint" and filed Mar. 12, 1998.

BACKGROUND OF THE INVENTION

The present invention relates to a paint roller. More particularly, it relates to a paint roller adapted to allow selective positioning and repositioning of a tubular paint applicator relative to a handle.

Countless people engage in home-related painting projects on a daily basis. In particular, as part of normal upkeep and/or improvement efforts, interior and exterior walls, floors, ceilings, etc. are often painted and repainted over the course of several years. While the types and colors of paint available have continually evolved, the tools used to apply paint have basically remained the same.

A standard paint brush is a very common tool used to apply a coat of paint to a wall or similar surface. When the surface area to be painted is relatively large, however, the use of a paint brush can be quite time consuming and tiresome. Alternatively, compressed air paint sprayers have more recently been made available. While a paint sprayer is able to distribute a large volume of paint in a relatively short time period, the costs associated with such a device are very high. As a result, while the compressed air paint sprayer can greatly reduce the time required for paint application, it is not a viable alternative to most individuals due to its high costs. Further, it is often times difficult to paint tight spaces with a paint sprayer.

A third, widely available alternative is a hand-held paint roller. The paint roller tool is generally inexpensive, and can be used to apply paint over a large surface area in a relatively short period of time.

Generally speaking, a standard paint roller includes a handle, a U-shaped shaft and a tube receiving frame. One end of the U-shaped shaft extends from the handle. The tube receiving frame is rotatably secured to a second end of the shaft. In this regard, the tube receiving frame is sized to selectively receive and maintain a tubular paint applicator. With this design, prior to use, a user simply inserts a clean tubular paint applicator over the rotatable frame. The tubular paint applicator is then covered with paint. For example, a volume of paint can first be poured into a receptacle, such as a pan. The tubular paint applicator is then dipped into the pan and then rolled back and forth. Once the tubular paint applicator is adequately soaked with paint, the paint roller is used to apply a coating of paint.

Application of paint with the paint roller is a relatively straight forward process. The user grasps the paint roller by the handle and contacts the desired surface with the tubular paint applicator. The handle is pivoted at a slight angle relative to the surface to be painted (and thus relative to the tubular paint applicator) so that the user can maintain constant contact between the surface and tubular paint applicator. Once in this position, the user maneuvers the handle in an up-and-down or back-and-forth motion. Because the tubular paint applicator is rotatably secured to the shaft, the tubular paint applicator rotates along the wall surface in response to movement of the handle by the user. With this configuration, then, the user is then able to rapidly cover a large surface area with a simple up-and-down, or back-and-forth, motion.

The standard paint roller design does address at least one ergonomic concern. Namely, by employing a U-shaped shaft, the standard paint roller design centrally positions the tubular paint applicator perpendicular to an axis of the handle. This orientation allows a user to use a painting motion generally parallel to an axis of the user's forearm. In other words, the user can grasp the handle within his or her palm and then hold the handle at a slight angle relative to the surface being painted. In this way, the user can rotate the tubular paint applicator along the wall surface, yet avoid contact with the wall with his or her hand.

While the U-shaped shaft satisfies one important ergonomic issue, other drawbacks with the standard paint roller design exist. For example, it is virtually impossible to use a paint roller near a corner, such as between a wall and ceiling. Under these circumstances, the user is unable to use the paint roller in the above-described manner. Once again, the U-shaped shaft orientates the tubular paint applicator perpendicular to the handle. Thus, when the handle is grasped in a normal fashion, the tubular paint applicator will be parallel to the corner formed between a wall and ceiling. Because the paint applicator is cylindrical, it is impossible for the tubular paint applicator to contact the wall at the corner without also undesirably contacting the ceiling. The only available solution is for the user to rotate his or her arm and wrist 90 degrees so that an end of the tubular paint applicator fits into the corner being painted. It should be recognized that this positioning of the wrist, arm and shoulder is very uncomfortable and presents a limited range of movement.

An additional concern arises when attempting to paint elevated surfaces. In this scenario, the normal solution is for the user to employ a ladder. Use of a ladder does allow the user to reach elevated surfaces. Unfortunately, however, only a small area can be painted before the user is required to descend and move the ladder. Even if an elongated handle is employed, a distinct problem remains. Namely, because the U-shaped shaft is rigid, it is very difficult for a user to properly orientate the handle when maneuvering the paint roller. In other words, the U-shaped shaft cannot easily be maintained at a large enough angle relative to the wall (or other surface) to provide appropriate leverage to the user. Importantly, this same concern arises in a number of different painting situations. For example, when painting a ceiling, it is often times difficult for the user to provide sufficient force, via the handle, to the tubular paint applicator for adequate paint distribution. Similarly, when painting a high surface with a paint roller having an elongated handle, the user is required to stand extremely close to the wall in question. As a result, because of the minimal angular displacement of the tubular paint applicator and the handle, it is extremely difficult to apply sufficient force to the tubular paint roller.

Paint rollers continue to be cost effective painting tools. However, several drawbacks exist with the standard paint roller design. Therefore, a substantial need exists for a paint roller designed to facilitate natural ergonomic movements for painting high surfaces, ceilings and corners.

SUMMARY OF THE INVENTION

One aspect of the present invention relates to a paint roller apparatus for use with a tubular paint applicator. The apparatus includes a shaft, a tube-receiving frame, a handle, and a connector. The shaft defines a first end and a second end. The tube-receiving frame is rotatably attached to the second end of the shaft. The handle includes a leading section that defines a plurality of shaft-receiving passages and a bore. The passages each extend from a respective opening in the handle, and are sized to slidably receive the first end of the shaft. The bore extends from a side face of the handle in a generally perpendicular fashion relative to an axis of each of the passages. In this regard, the bore intersects each of the passages. Finally, the connector includes a shank sized for placement within the bore. With this in mind, the apparatus is adapted such that upon insertion of the first end of the shaft into one of the passages, the shaft is selectively locked relative to the handle via advancement of the shank within the bore. In one preferred embodiment, three, non-parallel passages are provided.

Another aspect of the present invention relates to a method of assembling a paint roller apparatus. The method includes providing a shaft defining a first end and a second end, with a tube-receiving frame being rotatably attached to the second end. A handle is provided that includes a leading section that defines a plurality of shaft-receiving passages and a bore. The shaft-receiving passages each extend from a respective opening in the handle and are sized to slidably receive the first end of the shaft. The bore extends from a side face of the handle and intersects each of the passages. The first end of the shaft is inserted into one of the passages. The shaft is positioned to a desired rotational orientation relative to the handle. Finally, a portion of a connector is advanced within the bore to lock the shaft relative to the handle.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a plan view of a paint roller in accordance with the present invention;

FIG. **2** is an enlarged cross sectional view of a flexure joint portion of the paint roller of FIG. **1**;

FIG. **3** is a plan view of an alternative paint roller in accordance with the present invention;

FIG. **4**A is a perspective view of flexure joint portion of the paint roller of FIG. **3**;

FIG. **4**B is a cross-sectional view of the flexure joint of FIG. **4**A;

FIG. **5** is a plan view of the paint roller of FIG. **3** in an angularly displaced orientation;

FIG. **6** is an exploded, plan view of a paint roller apparatus in accordance with the present invention;

FIG. **7** is a side, perspective view of a handle portion of FIG. **6**; and

FIG. **8** is an enlarged, cross-sectional view of a portion of the paint roller of FIG. **6** upon final assembly.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A preferred embodiment of a paint roller **10** is shown in FIG. **1**. The paint roller **10** includes a handle **12**, a shaft **14**, a flexure joint **16** and a tube receiving frame **18**. The tube receiving frame **18** is shown in FIG. **1** as being generally encompassed by a tubular paint applicator **20**. The handle **12** is selectively secured to an end of the shaft **14** by the flexure joint **16**. Further, the tube receiving frame **18** is rotatably secured to an opposite end of the shaft **14**.

The handle **12** preferably includes a grip portion **22** and a neck **24**. In a preferred embodiment, the grip portion **22** is made of a molded plastic and is sized to rest within a user's hand (not shown). In this regard, the grip portion **22** may include finger articulations for enhancing fit with a user's hand. The neck **24** extends from a leading end **26** of the grip portion **22** and is preferably made of a rigid material, such as stainless steel. The neck **24** terminates at the flexure joint **16**. While the grip portion **22** and the neck **24** have been described as separate components, the handle **12** may be integrally formed of a single material. In fact, the neck **24** can be eliminated entirely. Further, the grip portion **22** and the neck **24** may be made from other rigid material, such as aluminum, ceramic, etc.

The shaft **14** forms an approximate U-shape, and includes a first end **28** and a second end **30**. The first end **28** is secured to a portion of the flexure joint **16**. The second end **30** is rotatably secured to the tube receiving frame **18**. The shaft **14** is preferably a rigid rod, formed from a strong material, such as stainless steel. As shown in FIG. **1**, the shaft **14** approximates the U-shape associated with a "standard" paint roller design. It should be understood, however, that other shapes and materials, such as plastic or aluminum, are equally acceptable.

The tube receiving frame **18** is of a type commonly known in the art and is rotatably secured to the shaft **14**. In this regard, the tube receiving frame **18** may include a ball bearing system (not shown) to provide rotatable association with the shaft **14**. Further, the tube receiving frame **18** preferably includes axially extending rods (not shown) sized to frictionally maintain the tubular paint applicator **20**.

The flexure joint **16** is configured to provide repositionable orientation of the shaft **14** relative to the handle **12**. In one preferred embodiment, as shown in FIG. **2**, the flexure joint **16** includes a spherical member **40**, a receiving member **42** and a connector **44**. In a preferred embodiment, the spherical member **40** is attached to the neck **24** of the handle **12**. The receiving member **42**, in turn, is secured to the first end **28** of the shaft **14**. Finally, the connector **44** is releasably secured to the spherical member **40** and the receiving member **42**.

The spherical member **40** is preferably an enlarged stainless steel ball bearing secured to the neck **24**. In one preferred embodiment, the spherical member **40** has a diameter of 1 inch, although it should be recognized that other diameters, either greater or smaller, are also available. Further, the spherical member **40** preferably includes an interiorly threaded portion **46** sized to received a similarly threaded portion (not shown) of the neck **24**. It should be understood, however, that other materials and forms of attachment are equally acceptable. For example, the spherical member **40** can be welded or otherwise adhered to the neck **24**. Alternatively, the interiorly threaded portion **46** may simply be a bore sized to be frictionally received and maintained by the neck **24**. Even further, the neck **24** and the spherical member **40** can be integrally formed during manufacture. Regardless of the exact construction, the spherical member **40** provides a circumferential engagement surface **48**.

The receiving member **42** preferably includes an exteriorly threaded flange **50**, forming an aperture **52**. In this regard, a leading end of the flange **50** forms an engagement ring **54**. The receiving member **42** is preferably made from a hardened material, such as stainless steel. However, other rigid materials, such as copper, plastic, etc. are acceptable. As should be noted from FIG. **2**, a diameter of the aperture **52** formed by the flange **50** is less than a diameter of the spherical member **40**. The receiving member **42** is preferably welded to the shaft **14**. Alternatively, other forms of attachment, such as an adhesive or a frictional fit, are acceptable.

The connector **44** is preferably a wing nut including a receiving member engagement surface **56** and a spherical member engagement surface **58**. The receiving member engagement surface **56** is threaded to threadably engage the exterior threads of the flange **50**. In this regard, the receiving member engagement surface **56** has a diameter greater than a diameter of the spherical member **40**. Conversely, the spherical member engagement surface **58** generally forms a ring having an inner diameter less than a diameter of a spherical member **40**. Thus, the receiving member engagement surface **56** can pass over the spherical member **40**. The spherical member engagement surface **58**, however, will engage the spherical member **40**.

While the connector **44** has been described as preferably being a wing nut to facilitate grasping by a user, other forms are acceptable. For example, the connector **44** can be a generic nut or a spring-loaded clamp configured to selectively engage either the spherical member **40** or the receiving member **42**.

The flexure joint **16** is assembled as follows. The connector **44** is axially disposed over the neck **24**. The spherical member **40** is then secured to the neck **24**. As shown in FIG. **2**, then, the connector **44** is now associated with the neck **24** such that it cannot entirely pass over the spherical member **40**. The receiving member **42** is secured to the first end **28** of the shaft **14**. The connector **44** is then positioned over the neck **24** such that the receiving member engagement surface **56** extends beyond the spherical member **40**. The receiving member **42** is threadably secured to the connector **44** via the receiving member engagement surface **56**.

More particularly, the connector **44** is rotated relative to the receiving member **42** such that the threaded surfaces engage one another. As the connector **44** further engages the receiving member **42**, the flange **50** is directed toward the spherical member **40**. This movement is continued until the engagement ring **54** of the receiving member **42** contacts the spherical member **40**. As shown in FIG. **2**, in this engaged position, a portion of the spherical member **40** extends into the aperture **52** of the receiving member **42**. The connector **44** is then tightened to lock the flexure joint **16**. In this locked positioned, the spherical member engagement surface **58** of the connector **44** is secured against the spherical member **40**. Further, the engagement ring **54** of the receiving member **42** is also secured to the spherical member **40**. As a result, the attached shaft **14** and the handle **12** are likewise locked relative to one another.

Position of the shaft **14** relative to the handle **12** can be altered by simply loosening the connector **44**. As the connector **44** is at least partially unthreaded from the receiving member **42**, the engagement ring **54** of the receiving member **42** is released from the spherical member **40**. Likewise, the spherical member engagement surface **58** of the connector **44** is disengaged from the spherical member **40**. In this released position, the shaft **14** can be repositioned relative to the neck **24** (and thus the handle **12**). Due to the spherical nature of the spherical member **40**, the shaft **14** can be maneuvered in virtually any direction relative to the handle **12**. As the shaft **14** is maneuvered or rotated relative to the neck **24**, the receiving member **42** and the connector **44** move in a similar fashion. Once the shaft **14** is at a second, desired position, the connector **44** is simply tightened relative to the receiving member **42**. Once again, this entails rotating the connector **44** relative to the receiving member **42** until the engagement ring **54** and the spherical member engagement surface **58** lock against the spherical member **40**.

Returning to FIG. **1**, the above-described flexure joint **16** provides for repositioning of the shaft **14** relative to the handle **12** from a first position (shown with continuous lines) to a second position (shown with dashed lines). Because the flexure joint **16** includes the spherical member **40** (FIG. **2**), the shaft **14** can be maneuvered to virtually any position along the circumferential engagement surface **48** of the spherical member **40** so long as the connector **44** is able to engage the spherical member **40** as previously described. For example, the shaft **14** can be rotated about a plane parallel to a central axis of the handle **12**, or radially about the circumferential engagement surface **48**. Thus, while FIG. **1** depicts the second position (dashed lines) as being a counterclockwise (or center-left) movement of the shaft **14** relative to the handle, center-right, center-forward or center-rearward movement and angle in between are also available. This preferred attribute afford a user (not shown) the ability to address a wide variety of painting situations. For example, moving the shaft **14**, and thus the attached tubular paint applicator **20**, forward relative to the handle **12**, a slight forward angular displacement is generated. This forward angular displacement is applicable when painting ceilings, floors, elevated surface, and assists in providing necessary leverage to a user. Further, the shaft **14** can be repositioned radially relative to the handle **12** for corner painting.

While the flexure joint **16** of the preferred embodiment has been shown as being positioned near the grip portion **22** of the handle **12**, other locations are equally acceptable. For example, the flexure joint **16** can be positioned along the shaft **14** proximate the tube receiving frame **18**. With this configuration, the shaft **14** is essentially defined by two sections; a paint applicator section and a handle section. The handle section of the shaft **14** is essentially an extension of the neck **24**. In other words, the neck **24** and the shaft **14** are integrally formed such that the handle section of the shaft **14** is attached to the handle **12**. The paint applicator section of the shaft **14** is rotatably secured to the tube receiving frame **18**. The flexure joint **16** selectively secures the two sections of the shaft **14** as previously described. In other words, at least a portion of the shaft **14**, and thus the tube receiving frame **18**, is repositionable relative to the handle **12**.

While the flexure joint **16** has been preferably described as including the spherical member **40**, the receiving member **42** and the connector **44**, other repositionable attachment means are acceptable. For example, the spherical member **40** may be attached to the shaft **14**, whereas the receiving member **42** is associated with the handle **12**. Even further, an entirely different attachment means can be provided. For example, the attachment means **16** may include a spring actuated lever positioned to provide for a locked, repositionable orientation of the shaft **14** relative to the handle **12**. Even further, a ratchet-type assembly or a pin retention system can be used. Regardless of the specific design, the attachment means **16** is configured to provide a user with the ability to selectively change position of the tube receiving frame **18** (and thus an attached tubular paint applicator **20**) relative to the handle **12** via movement of at least a portion of the shaft **14**. The attachment means **16** is simply configured to selectively lock the paint roller **10** in a desired position regardless of whether a round, square or any other shaped component is used. Importantly, it is not necessary that the attachment means **16** provide the degrees of freedom offered by the preferred embodiment. In other words, the attachment means **16** need only be configured to allow one degree of freedom for many applications.

In another alternative embodiment, the handle **12** includes a receiving means **60** positioned at a trailing end **62** of the handle **12**. The receiving means **60** is configured to receive and engage a portion of an extension device (not shown). The extension device may be an elongated rod or other apparatus used to effectively extend a length of the handle **12** for a user. In one embodiment, the receiving means **60** is an interiorly threaded bore sized to threadably receive an exteriorly threaded end of the extension device. Alternatively, a friction fit or other engagement approach may be used.

Another alternative embodiment of a paint roller **100** is shown in FIG. **3**. As with previous embodiments, the paint roller **100** includes a handle **102**, a shaft **104**, a flexure joint **106** and a tube receiving frame **108**. The tube receiving frame **108** is shown in FIG. **3** as being generally encompassed by a tubular paint applicator **110**. The handle **102** is selectively secured to an end of the shaft **104** by the flexure joint **106**. Further, the tube receiving frame **108** is rotatably secured to an opposite end of the shaft **104**.

The handle **102** is preferably similar to the handle **12** (FIG. **1**) previously described. Thus, in a preferred embodiment, the handle **102** includes a grip portion **112** and a neck **114**, with the neck **114** terminating at the flexure joint **106**. Alternatively, other shapes, configurations and/or constructions known in the art can be employed.

The shaft **104** is likewise preferably similar to the shaft **14** (FIG. **1**) previously described, preferably forming an approximate U-shape and including a first end **116** and a second end **118**. The first end **116** is preferably secured to a portion of the flexure joint **106**, whereas the second end **118** is preferably secured to the tube receiving frame **108**. Alternatively, other shapes, configurations and/or constructions know in the art can be employed.

The tube receiving frame **108** is preferably similar to the tube receiving frame **18** (FIG. **1**) previously described. In this regard, the tube receiving frame **108** is preferably rotatably secured to the shaft **104**.

The flexure joint **106** is, similar to the flexure joint **16** (FIG. **2**) previously described, configured to provide for a repositionable, "locked" orientation of the shaft **104** relative to the handle **102**. The flexure joint **106** includes a spherical member **120**, a receiving member **122** and a connector **124**. In one preferred embodiment, the spherical member **120** is attached to the first end **116** of the shaft **104**, whereas the receiving member **122** is attached to the neck **114** of the handle **102**. Alternatively, location of the spherical member **120** and the receiving member **122** can be reversed. Regardless, the connector **124** is connected to the receiving member **122** to releasably secure the spherical member **120** to the receiving member **122**.

The spherical member **120** is preferably similar to the spherical member **40** (FIG. **2**) previously described. In one preferred embodiment, the spherical member **120** is a stainless steel ball bearing having a diameter of approximately 0.687 inch, although other materials and diameters are equally acceptable. Further, the spherical member **120** preferably forms a bore **126** for facilitating attachment to the first end **116** of the shaft **104**, such as by a weld. Alternatively, other attachment techniques known in the art, such as threading, adhesives, frictional fit, etc., are equally acceptable. Even further, the spherical member **120** and the shaft **104** (or, in accordance with an alternative embodiment, the spherical member **120** and the neck **114** of the handle **102**) can be integrally formed. Regardless, the spherical member **120** provides a circumferential engagement surface **128**.

The receiving member **122** is shown in greater detail in FIGS. **4**A and **4**B. In a preferred embodiment, the receiving member **122** is generally Y-shaped, defined by a shoulder **140** and a clamp **142**. The clamp **142** extends in a substantially uniform fashion from the shoulder **140**.

The shoulder **140** is preferably configured for attachment to the neck **114** (FIG. **3**), forming a longitudinal bore **144** and a transverse pin passage **146**. The longitudinal bore **144** is sized to receive the neck **114**, and can be interiorly threaded to promote a more complete engagement with the neck **114**. The transverse pin passage **146** extends through the longitudinal bore **144** and is sized to receive and frictionally maintain a roll pin (not shown). The roll pin effectively affixes the neck **114** to the shoulder **140**. Alternatively, the shoulder **140** can be configured for other forms of attachment to the neck **114** (or, in an alternative embodiment, to the shaft **104** (FIG. **3**)), such as by a weld, adhesive, etc. With these alternative configurations, one or more of the longitudinal bore **144** and the transverse pin passage **146** can be eliminated.

The clamp **142** includes opposing flanges or arms **148***a*, **148***b* separated by a longitudinal slot **150**. In this regard, the opposing arms **148***a*, **148***b* preferably extend in a substantially identical fashion from the shoulder **140**. Each of the opposing arms **148***a*, **148***b* forms an outer surface **152**, an inner surface **154** (defined by the slot **150**), a ball receiving groove **156** and a connector receiving passage **158**. The ball receiving grooves **156** are aligned with one another. Likewise, the connector receiving passages **158** are also aligned with one another, with the ball receiving grooves **156** being spaced distally from the connector receiving passages **158** (relative to the orientations of FIGS. **3**, **4**A and **4**B).

The opposing arms **148***a*, **148***b* are preferably formed such that the outer surfaces **152**, respectively, are substantially flat, having a width in the range of 0.5–1.5 inches; more preferably in the range of 0.75–1.25 inches; most preferably approximately 1 inch. The inner surfaces **154**, respectively, are substantially flat, forming a concave channel **160** in one preferred embodiment. The concave channels **160** are preferably identical, each extending from a leading end **162** of the clamp **142** to at least the respective ball receiving groove **156**. The concave channels **160** are sized in accordance with a diameter of the spherical member **120** (FIG. **3**) so as to facilitate initial assembly of the spherical member **120** to the receiving member **122**, as described in greater detail below. Thus, in one preferred embodiment, a spacing of the inner surfaces **154** of the opposing arms **148***a*, **148***b* (or height of the slot **150**) is smaller than a diameter of the spherical member **120**, except in the region of the concave channels **160** whereby the spacing approximates, or is only slightly smaller than, a diameter of the spherical member **120**. As a result, the spherical member **120** can relatively easily slide along the concave channels **160** into engagement with the ball receiving grooves **156**. Alternatively, with other assembly techniques, the concave channels **160** need not be formed.

As depicted in FIGS. **4**A and **4**B, the slot **150** is elongated, extending proximally from the leading end **162** of the clamp **142** and preferably defining a first region **164** and a second region **166**. A height of the first region **164** is preferably greater than a height of the second region **166**. That is to say, the slot **150** is preferably formed such that a spacing between the opposing arms **148***a*, **148***b* is greater along the first region **164** than the second region **166**. With this configuration, the first region **164** preferably extends proximally beyond at least the connector receiving passages **158**, respectively. The height of the first region **164** (or spacing between the opposing arms **148***a*, **148***b*) corresponds with a diameter of the spherical member **120** (FIG. **3**) as well as a thickness of the shaft **104** (FIG. **3**). More particularly, the height of the first region **164** is preferably less than a diameter of the spherical member **120** such that the spherical member **120** is retainable between the opposing arms **148***a*, **148***b*, in a labeled position as described below. Further, to facilitate a wide range of motion of the shaft **104** relative to the handle **102** (FIG. **3**), the height of the first region **164** (especially in a locked position of the clamp **142**) is preferably greater than a thickness of the shaft **104**. In other words, as described in greater detail below, the first region **164** is sized to allow passage of the shaft **104** within the first region **164**. With these preferred constraints in mind, in one preferred embodiment where the spherical member **120** has a diameter of approximately 0.687 inch and the shaft **104** has a thickness or diameter of approximately 0.375 inch, the height of the first region **164** is approximately 0.4 inch. Alternatively, other heights or spacings are equally acceptable.

As described below, incorporation of the slot **150** allows the opposing arms **148***a*, **148***b* to slightly deflect toward or away from one another to engage or release the spherical member **120** (FIG. **3**). By forming the slot **150** to be elongated (in a longitudinal direction), the opposing arms **148***a*, **148***b* are more easily deflectable at a trailing end **168** of the slot **150**. Thus, by forming the slot **150** to further include the second region **166**, an overall length of the slot **150** is increased. However, in a preferred embodiment, the second region **166** has a height (or spacing between the opposing arms **148***a*, **148***b*) that is less than the first region **164**, with the second region **166** terminating at the trailing end **168**. With this preferred configuration, the desired, relatively easy deflection characteristic is achieved, with the opposing arms **148***a*, **148***b* pivoting relative to one another at the trailing end **168**. Further, an overall strength of the clamp **142** is enhanced. That is to say, the opposing arms **148***a*, **148***b* are preferably thicker in the area of the second region **166**, and in particular the trailing end **168**, such that the clamp **142** is less likely to fail over time. Alternatively, however, the slot **150** can be formed to have a relatively uniform height.

The ball receiving grooves **156** are formed transverse to the slot **150**, and are configured to receive and maintain the spherical member **120** (FIG. **3**). In one preferred embodiment, for ease of manufacture, the ball receiving grooves **156** are bores extending through the respective opposing arm **148***a*, **148***b*. Alternatively, the ball receiving grooves **156** need not extend through the respective arm **148***a*, **148***b*, instead being formed at the respective inner surface **154**. Regardless, the ball receiving grooves **156** are sized to be slightly smaller than a diameter of the spherical member **120** such that the spherical member **120** is retainable within each of the ball receiving grooves **156**. For example, in accordance with a preferred embodiment whereby the spherical member has a diameter of approximately 0.687 inch, each of the ball receiving grooves preferably defines a diameter of approximately 0.5 inch. Alternatively, other dimensions are equally acceptable. Regardless, the ball receiving grooves **156** are configured to engage the spherical member **120** in a locked position, as well as to generally retain while allowing rotation of the spherical member **120** in virtually any direction in an unlocked position.

The connector receiving passages **158** are spaced from the ball receiving grooves **156**, and are configure to selectively retain the connector **124** (FIG. **3**). For example, in one preferred embodiment, the connector receiving passage **158** associated with the arm **148***a* provides clearance about a portion of the connector, whereas the connector receiving passage **158** associated with the arm **148***b* is interiorly threaded for threadably engaging a corresponding portion of the connector **124**. Alternatively, other attachment configuration are equally acceptable. Regardless, the connector receiving passages **158** are preferably spaced (longitudinally) from the ball receiving grooves a sufficient distance to allow clearance from the spherical member **120** (FIG. **3**) upon final assembly, but close enough to provide an appropriate clamping force. As described below, the connector **124** will force the opposing arms **148***a*, **148***b* toward one another to secure the spherical member **120** in a locked position. By positioning the connector receiving passages **158** in relative close proximity to the ball receiving grooves **156**, the clamping force provided by the connector **124** will relatively rigidly maintain the spherical member **120** within the clamp **142** in a locked position. For example, in one preferred embodiment, a center of the connector receiving passages **158** is spaced from a center of the ball receiving grooves **156** by approximately 0.625 inch, although other dimensions are equally acceptable.

In a preferred embodiment, the shoulder **140** and the clamp **142** are integrally formed from a high strength material, preferably T6 aluminum. Alternatively, other high strength materials, such as metals or metal alloys, plastic, ceramic, etc., are also acceptable.

Returning to FIG. **3**, the connector **124** is preferably a bolt, including a shank **170** and a head **172**. The shank **170** is sized to preferably configure through one of the connector receiving passage **158** (FIG. **4**B) and threadably engage the other connector receiving passage **158** (FIG. **4**B) as previously described. Conversely, the head **172** has a width greater than the connector receiving passages **158** such that head **172** will abut the outer surface **152** of the arm **148***a*. Alternatively, the connector **124** can assume other configurations known in the art.

With additional reference to FIGS. **4**A and **4**B, the flexure joint **106** is assembled by disconnecting the connector **124**. The spherical member **120** is placed into engagement with the receiving member **122**. More particularly, the spherical member **120** is aligned with the clamp **142** at the leading end **162**, and then slid along the concave channels **160** into contact with the ball receiving grooves **156**. Notably, the opposing arms **148***a*, **148***b* will deflect slightly at the trailing end **168** of the slot **150** to allow passage of the spherical member **120**. The circumferential surface **128** of the spherical member **120** is thereby retained within the ball receiving groove **156** in this unlocked position such that the spherical member **120** will not easily disengage the ball receiving grooves (due to a light clamping force of the opposing arms **148***a*, **158***b*, but can easily rotate within the ball receiving grooves **156**.

Once the spherical member **120** is inserted within the ball receiving grooves **156**, the connector **124** is tightened relative to the clamp **142**, forcing the opposing arms **148***a*, **148***b* toward one another. This tightening action effectively "locks" the spherical member between the opposing arms **148***a*, **148***b* at the ball receiving grooves **156** in an engaged or locked position. As a result, the shaft **104** and the handle **102** are likewise locked to one another.

Orientation and positioning of the shaft **104** relative to the handle **102** can be altered by simply loosening the connector **124**. As the connector **124** is at least partially loosened, the opposing arms **148***a*, **148***b* disengage or partially release the spherical member **120**. Preferably, however, the spherical member **120** remains within the ball receiving grooves **156** so that a general assembly of the flexure joint **106** remains intact. Once the clamping force imparted by the opposing arms **148***a*, **148***b* is decreased, the shaft **104** can be rotated to any position about a central axis A defined by the first end **116** of the shaft **104**/spherical member **120**. In addition, and with reference to FIG. **5**, the shaft **104** can be rotated or angularly displaced in a sideways fashion about an axis (into the sheet of FIG. **5**) perpendicular to the central axis A. In other words, with reference to the orientation of FIG. **5**, the shaft **104** can be rotated clockwise or counterclockwise, centered at the spherical member **120**, otherwise maintained generally within the ball receiving grooves **156**. To this end, the receiving member **122** does not overly inhibit angular displacement or rotation of the shaft **104**. More particularly, by forming the slot **150** (FIG. **3**) to have a height (or spacing between the opposing arms **148***a*, **148***b*) greater than a width or thickness of the shaft **104**, the shaft **104** can pass within the receiving member **122** as shown in FIG. **5**. Effectively, then, with reference to the orientation of FIG. **5**, the shaft **104** can be angularly displaced clockwise or counterclockwise until the shaft contacts a lower section of the receiving member **122**. With this configuration, the flexure joint **106** permits a wide range of angular displacement of the shaft **104** relative to the handle **102**. For example, with reference to the "upright" orientation of FIG. **3**, the flexure joint **106** allows the shaft **104** to be angularly displaced relative to the handle **102** by at least 30 degrees, more preferably by at least 60 degrees, even more preferably by at least 90 degrees (as shown in FIG. **5**), and most preferably by at least 135 degrees. Notably, the shaft **104** can be further rotated along the central axis C at any clockwise or counterclockwise angular position of the shaft **104**. Thus, the flexure joint **106** effectively provides two degrees of freedom of movement.

Once the shaft **104** (and thus the tubular paint applicator **110**) is located in a desired angular and rotational position relative to the handle **102**, the connector **124** is tightened so as to lock the spherical member **120** within the clamp **142**. The paint roller **100** is then available for use. Subsequently, depending upon the particular painting application, the connector **124** can be loosened, and the shaft **104** (and thus the tubular paint applicator **110**) maneuvered to a third angular and rotational position relative to the handle.

An alternative preferred embodiment paint roller apparatus **200** is shown in FIG. **6**. The paint roller **200** includes a shaft **202**, a handle **204**, a connector **206**, and a frame **208**. Details on the various components are provided below. In general terms, however, the frame **208** is rotatably secured to the shaft **202** and is adapted to receive a tubular paint applicator (similar to the tubular paint applicator **20** of FIG. **1**). An opposite end of the shaft **202** is connectable to the handle **204**, with the connector **206** selectively locking the shaft **202** relative to the handle **204** in a desired angular orientation and rotational position.

As with previous embodiments, the shaft **202** forms an approximate U-shape, and includes a first end **220** and a second end **222**. The frame **208** is rotatably secured to the second end **222**. The first end **220**, however, is adapted to be slidably received within a passage provided by the handle **204**, as described in greater detail before. Further, the first end **220** provides a plurality of flattened surfaces **224** (referenced generally in FIG. **6**) that facilitates locked engagement with the connector **206**. That is to say, the first end **220** is preferably not rounded (or circular in cross-section), with the flattened surfaces **224** providing sufficient surface area for engaging contact with a portion of the connector **206**, as described below.

In one preferred embodiment, the first end **220** defines a square in transverse cross-section, such that four of the flattened surfaces **224** are provided, three of which (**224***a*–**224***c*) are identified in FIG. **6**. Alternatively, the first end **220** can be configured to provide more or less of the flattened surfaces **224**, such as by being triangular, octagonal, etc., in transverse cross-section. Regardless, each of the flattened surfaces **224** are identical, having a preferred length (relative to a tip **226** of the first end **220**) in the range of 0.5–1 inch, more preferably 0.75 inch. In a most preferred embodiment, the first end **220** is a squared body having a length and width of 0.25 inch. In conjunction with the handle **204** and the connector **206** described below, it has been surprisingly found that a 0.25 inch squared body having a length of 0.75 inch provides adequate surface area for engagement by the connector **206** to achieve a desired locked orientation.

The handle **204** includes a trailing section **230**, an intermediate section **232**, and a leading section **234**. Similar to previous embodiments, the trailing section **230** is preferably configured to receive and engage a portion of an extension device (not shown), such as by an interiorly threaded bore (not shown). Similarly, the intermediate section **232** preferably includes finger articulations **236** adapted for enhancing a fit within a user's hand.

The leading section **234** is adapted to selectively receive and maintain the first end **220** of the shaft **202** via a plurality of shaft-receiving passages **238** (referenced generally in FIG. **6**) and a bore **240**. Each of the passages **238** are sized to slidably receive the first end **220** of the shaft **202**. The bore **240** is sized to receive a portion of the connector **206** and intersects each of the passages **238**.

Each of the passages **238** preferably extend in a non-parallel fashion relative to each other. The varying angular orientation of each of the passages **238** provide a corresponding, varying angular orientation of the shaft **202** relative to the handle **204** upon final assembly. For example, in one preferred embodiment, three of the passages **238** are provided, with a first passage **238***a* extending parallel with a central axis H of the handle **204**. A second one of the passages **238***b* extends in an angular fashion relative to the handle axis H, preferably defining an angle of approximately 60° (±5°) relative to the handle axis H. A third one of the passages **238***c* also extends at an angular fashion relative to the handle axis H, preferably at a differing angle. More particular, in one preferred embodiment, the third passage **238***c* defines an angle of approximately 30° (±5°) relative to the handle axis H. Other angular orientations of the passages **238***a*–**238***c* can also be employed.

In conjunction with the above-described positioning of the passages **238** relative to the handle axis H, the leading section **234** is further preferably configured to facilitate easy identification of the resultant shaft **202**/handle **204** positioning upon final assembly via a top surface **242** thereof. With the preferred embodiment of three of the passages **238***a*–**238***c*, the top surface **232** is preferably configured to define first, second, and third top surface portions **244***a*, **244***b*, **244***c*, respectively. The first passage **238***a* extends from an opening **246***a* in the first top surface portion **244***a*. Similarly, the second passage **238***b* extends from an opening **246***b* in the second top surface portion **244***b*. Finally, the third passage **238***c* extends from an opening **246***c* in the third top surface portion **244***c*. The top surface portions **244***a*–**244***c* are preferably oriented such that the corresponding passage **238**a –**238**c extends in a generally perpendicular fashion relative to a plane defined by the respective top surface portion **244**a –**244**c. With this in mind, and in one preferred embodiment, then, the second top surface portion **244**b extends from the first top surface portion **244**a at an angle that is different from an extension of the third top surface portion **244**c relative to the first top surface portion **244**a. For example, in one preferred embodiment, the first and second top surface portions **244**a, **244**b define an angle of approximately 240° (±5°), whereas the first and third top surface portions **244**a, **244**c combine to define an angle of approximately 210° (±5°). Again, other angular extensions are acceptable. Regardless, a user can quickly discern by simply viewing a relationship of the second or third top surface portions **244**b, **244**c relative to the first top surface portion **244**a as to what the final angular orientation of the shaft **202** relative to the handle **204** will be upon final assembly. The angular orientation of the second top surface portion **244**b relative to the first top surface portion **244**a is illustrated in greater detail in FIG. **7**.

In one preferred embodiment, each of the passages **238** are co-planar. Alternatively, one or more of the passages **238** can be offset relative to others of the passages **238**.

As previously described, the bore **240** is positioned and extends in a manner so as to intersect with each of the shaft-receiving passages **238**. As shown in FIG. **7**, and in one preferred embodiment, the bore **240** extends from an opening **250** formed in a side face **252** of the leading section **234**. By intersecting each of the passages **238**, the bore **240** facilitates locking of the shaft **202** relative to the handle **204**, with the first end **220** placed in one of the passages **238** via the connector **206**. In this regard, the bore **240** preferably extends in a substantially perpendicular fashion (i.e., ±5°) relative to an axis of each of the passages **238**.

The bore **240** is preferably centered relative to opposing side faces **252**a, **252**b of the leading section **234** as shown in FIG. **6**. Further, the bore **240** is preferably positioned a sufficient distance below the first top surface portion **244**a to ensure that a sufficient length of the first end **220** of the shaft **202** is inserted within the first passage **238**a upon final assembly. By way of reference, each of the passages preferably has a depth of approximately 1 inch. This preferred depth, in conjunction with a preferred location of the bore **240** has surprisingly been found to provide sufficient surface area engagement between the handle **204** and the shaft **202** in the locked state as a relatively lengthy portion of the shaft **202** is supported within the handle **204**. In one preferred embodiment, the bore **240** is positioned approximately 0.5625 inch below the first top surface portion **244**a.

The bore **240** is preferably interiorly threaded to facilitate coupling with the connector **206**. In this regard, the handle **204** can be manufactured to define the internal threads. Alternatively, a threaded metal insert **260** can be press fitted within the bore **240** as shown in FIG. **8**. Regardless, the bore **240** and/or the insert **260** has a sufficient length to ensure adequate threaded interaction with the connector **206**. Thus, in one preferred embodiment, the bore **240** has a length of approximately 0.3125 inch, although other dimensions are acceptable.

Returning to FIG. **6**, the connector **206** includes a shank **270** terminating in a tip **271**. In conjunction with the preferred threading of the bore **240** and/or the threaded insert **260**, the shank **270** preferably forms exterior threads sized to threadably engage the bore **240** or the threaded insert **260**. The tip **271** is preferably flat, and defines an engagement end of the connector **206**. In one preferred embodiment, the connector **206** is a wing nut that defines finger extensions **272**. Alternatively, other connectors known in the art are equally acceptable.

During use, the first end **220** of the shaft **202** is inserted into a selected one of the passages **238**. In this regard, a desired rotational orientation of the shaft **202** relative to the handle **204** can be determined prior to insertion of the first end **220**. Alternatively, the passages **238** can be configured to allow rotation of the first end **220** about an axis thereof following insertion (e.g., the passages **238** are circular in cross-section). Conversely, the passages **238** can be configured in accordance with a shape of the first end **220** such that a limited number of rotational positions are available when initially inserting the first end **220** (e.g., the first end **220** and the passages **238** are square in transverse cross-section).

Regardless, the first end **220** is fully inserted within the selected passage **238**. The connector **206** is then used to lock the shaft **202** relative to the handle **204**. In particular, and in one preferred embodiment, the connector **206** is maneuvered relative to the handle **204** such that the shank **270**, and in particular the tip or engagement end **271** is advanced within the bore **240**. For example, where the shank **270** is threadably secured within the bore **240**, the connector **206** is rotated in an appropriate direction to effectuate advancement within the bore **240**. Movement of the connector **206** continues until the engagement end **271** contacts the first end **220** of the shaft **202** (otherwise inserted within the desired passage **238**). In this regard, the preferred flattened surfaces **224** formed by the first end **220** provide a relatively large surface area for enhanced contact with the preferably flat tip **271** of the connector **206**. In one of the flattened surfaces is not fully aligned with the tip **271**, advancement of the shank **270** causes the first end **220** to rotate slightly within the passage **238** until a flattened surface **224** is aligned with the tip **271**. The connector **206** is then tightened, thereby locking the shaft **202** relative to the handle **204**.

As should be evident from the above, the paint roller **200** provides for a number of different shaft **202**/handle **204** angular orientations and rotational positions. With the one preferred embodiment in which three of the shaft-receiving passage **238**a–**238**c are provided and the first end **220** of the shaft **202** is square in transverse cross-section, the paint roller **200** provides for twelve possible angular/rotational positions of the shaft **202** relative to the handle **204**. By having the bore **240** intersect each of the passages **238**, the user can quickly assemble the paint roller **200** to any of the available angular orientations/rotational positions.

The paint roller of the present invention provides a marked improvement over the standard paint roller design. By providing a user with the ability to easily change orientation of an attached tubular paint applicator relative to the handle, a wide variety of new applications for the paint roller are now available. For example, a simple rotation of the shaft (and thus the attached paint applicator) relative to the handle facilitates painting a corner. Additionally, selecting a slight forward angle between the tubular paint applicator and the handle allows for expedient painting of elevated surfaces, including ceilings. Finally, the ability to create a forward angle between the tubular paint applicator on the handle results in a more ergonomically correct handling of the paint roller by a user, thus minimizing stress on the user's wrist, arm and shoulder.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art that changes may be made in form and detail without departing from the spirit and scope of the invention. For example, the paint roller of the present invention has been described as relating to a standard size. It should be recognized, however, that the present invention can be utilized with any sized paint roller. In this regard, the tube receiving frame is sized according to a length and inner diameter of the tubular paint applicator. In this same respect, because the paint roller allows for a relatively full range of movement of the shaft relative to the handle, it may not be necessary to incorporate the standard U-shaped shaft design. In other words, any of a number of different shapes and configurations are available.

What is claimed is:

1. A paint roller apparatus for use with a tubular paint applicator, the apparatus comprising:

a shaft defining a first end and a second end;

a tube-receiving frame rotatably attached to the second end;

a handle including a leading section defining:

a plurality of shaft-receiving passages each extending from a respective opening in the leading section, each of the passages being sized to slidably receive the first end of the shaft,

a bore extending from a side face of the handle in a generally perpendicular fashion relative to an axis of each of the passages, wherein the bore intersects each of the passages; and

a connector including a shank sized for placement within the bore;

wherein the paint roller apparatus is adapted such that upon insertion of the first end of the shaft into one of the passages, the shaft is selectively locked relative to the handle via advancement of the shank within the bore in a generally perpendicular fashion relative to an axis of the passage within which the first end of the shaft is received.

2. The apparatus of claim **1**, wherein the leading section forms three of the shaft-receiving passages.

3. The apparatus of claim **1**, wherein the plurality of passages are co-planar.

4. The apparatus of claim **1**, wherein the plurality of passages extend in a non-parallel fashion.

5. The apparatus of claim **1**, wherein the leading section defines a first top face portion and a second top face portion, the top face portions defining non-parallel planes, and further wherein a first one of the passages extends from an opening in the first top face portion and a second one of the passages extends from an opening in the second top face portion.

6. The apparatus of claim **5**, wherein the leading section further defines a third top face portion extending in a plane that is non-parallel relative to planes of the first and second top face portions, and further wherein a third one of the passages extends from an opening in the third top face portion.

7. The apparatus of claim **6**, wherein the first, second, and third passages extend in a perpendicular fashion relative to the first, second, and third top face portions, respectively.

8. The apparatus of claim **6**, wherein the second and third top face portions extend from opposing sides of the first top face portion and further wherein, an angle defined by the first and second top face portions is different from an angle defined by the first and third top face portions.

9. The apparatus of claim **8**, wherein an angle between the first and second top face portions is approximately 210° and an angle between the first and third top face portions is approximately 240°.

10. The apparatus of claim **1**, wherein the passages are each adapted to allow a plurality of rotational orientations of the shaft relative to the handle.

11. The apparatus of claim **1**, wherein the first end of the shaft defines a plurality of flattened surfaces.

12. The apparatus of claim **1**, wherein the first end of the shaft defines a square in transverse cross-section.

13. The apparatus of claim **1**, wherein the shank terminates in an engagement end adapted to contact the first end of the shaft in the locked position.

14. The apparatus of claim **1**, wherein the shank includes an exterior thread adapted to be threadably engaged within the bore.

15. The apparatus of claim **14**, wherein the bore defines interior threads adapted to threadably engage the shank.

16. The apparatus of claim **1**, wherein each of the passages have a uniform diameter extending between opposing ends, and further wherein the bore intersects each of the passages along a length thereof, spaced from the respective opposing ends.

17. A method of assembling a paint roller apparatus, the method comprising:

providing a shaft defining a first end and a second end, a tube-receiving frame being rotatably attached to the second end;

providing a handle including a leading section defining a plurality of shaft-receiving passages, each extending from respective openings in the handle and sized to receive the first end of the shaft, and a bore extending from a side face of the leading section and intersecting each of the passages;

inserting the first end of the shaft into one of the passages;

positioning the shaft at a desired rotational position relative to the handle; and

advancing a portion of the connector within the bore in a direction non-parallel with an axis of the passage within which the shaft is inserted to lock the shaft relative to the handle.

18. The method of claim **17**, further comprising:

selecting one of four available rotational orientations of the shaft relative to the handle.

19. A paint roller apparatus for use with a tubular paint applicator, the apparatus comprising:

a shaft defining a first end and a second end;

a tube-receiving frame rotatably attached to the second end;

a handle including a leading section defining:

a first top face portion,

a second top face portion,

wherein the top face portions define non-parallel planes,

a first shaft-receiving passage extending from an opening in the first top face portion,

a second shaft-receiving passage extending from an opening in the second top face portion, wherein the passages are each sized to slidably receive the first end of the shaft,

a bore extending from a side face of the handle in a generally perpendicular fashion relative to an axis of at least one of the passages, wherein the bore intersects each of the passages; and

a connector including a shank sized for placement within the bore;

wherein the paint roller apparatus is adapted such that upon insertion of the first end of the shaft into one of the passages, the shaft is selectively locked relative to the handle via advancement of the shank within the bore.

20. The apparatus of claim **19**, wherein the leading section further defines a third top face portion extending in a plane that is non-parallel relative to planes of the first and second top face portions, and further wherein a third passage extends from an opening in the third top face portion.

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